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Industrial Hygiene Digest

INDUSTRIAL HEALTH NEWS

LITERATURE ABSTRACTS

MEDICAL

ENGINEERING

CHEMICAL

TOXICOLOGICAL

LEGAL . . . decisions and trends

OCTOBER, 1959
(Vol. 23, No. 10)

INDUSTRIAL HYGIENE FOUNDATION
MELLON INSTITUTE
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INDUSTRIAL HYGIENE FEATURES

Litigation breeders in industrial medicine are discussed in Abst. No. 990.

The disease concept of alcoholism is the subject of Abst. No. 993.

The topic of Abst. No. 997 is the treatment of low back pain.

For a series of papers concerned with epilepsy see Abst. Nos. 998, 999, and 1000.

See Abst. No. 1005 for changes in the ten commonest dermatoses in private practice.

A discussion on gamma-globulin therapy in chronic staphylococcic dermatoses is presented in Abst. No. 1007.

For hazards in the manufacture and use of plastics see Abst. No. 1010.

The subject of Abst. No. 1011 is the toxicity of boron oxide.

Abst. No. 1015 is concerned with experimental cancers in rats produced by chromium compounds.

Information on the biochemical mechanisms in chronic carbon disulfide poisoning is contained in Abst. No. 1024.

Farmer's lung in mushroom workers is the objective of Abst. No. 1028.

See Abst. No. 1040 for details on the medical problems of shift-work.

Data on an improved cascade impactor measuring aerosol particle sizes are given in Abst. No. 1060.

Considered in Abst. No. 1064 are the veterinary aspects of air pollution.

The theme of Abst. No. 1072 is how to improve safety through organization.

Details on laboratory hoods are given in Abst. Nos. 1076 and 1077.

FOUNDATION FACTS

NEW TRUSTEE ELECTED TO I-H-F BOARD. Mr. Newell R. Johnson, General Manager of the American Mutual Insurance Alliance, has been elected to the Board of Trustees of the Industrial Hygiene Foundation.

THRESHOLD LIMIT VALUES. The Threshold Limit Values for 1959, adopted by the American Conference of Governmental Industrial Hygienists, appear in this issue of the Digest. The limit value for bromine was changes from 1.0 to 0.1 ppm, chloroform from 100 to 50 ppm, and chloropicrin from 1.0 to 0.1 ppm. The list now contains 250 compounds plus 25 tentative values.

24th ANNUAL MEETING THIS MONTH. The program and registration cards for the 24th Annual Meeting were mailed on September 17, and the number of registration cards returned has been most gratifying. We hope that the broad scope of subject matter and the distinguished roster of speakers will appeal to representatives of all of our member companies. We look forward to a profitable and interesting meeting. The officers of the Foundation also have a full program, with meetings scheduled for the Executive Committee and two meetings for the Board of Trustees.

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THRESHOLD LIMIT VALUES FOR 1959[1]

Adopted at the Twenty-First Annual Meeting of the American Conference of Governmental Industrial Hygienists, Chicago, April 25-28, 1959

Threshold limits should be used as guides in the control of health hazards and should not be regarded as fine lines between safe and dangerous concentrations. They represent conditions under which it is believed that nearly all workers may be repeatedly exposed, day after day, without adverse effect. The values listed refer to time weighted average concentrations for a normal work-day. The amount by which these figures may be exceeded for short periods without injury to health depends upon a number of factors such as the nature of the contaminant, whether very high concentrations even for short periods produce acute poisoning, whether the effects are cumulative, the frequency with which high concentrations occur, and the duration of such periods. All must be taken into consideration in arriving at a decision as to whether a hazardous situation exists. Special consideration should be given to the application of these values in the evaluation of the health hazards which may be associated with exposure to combinations of two or more substances.

Threshold limits are based on the best available information from industrial experience, from experimental studies, and, when possible, from a combination of the two. These values are based on various criteria of toxic effects or on marked discomfort; thus, they should not be used as a common denominator of toxicity, nor should they be considered as the sole criterion in proving or disproving diagnosis of suspected occupational diseases.

These limits are intended for use in the field of industrial hygiene and should be employed by persons trained in this field. They are not intended for use, or for modification for use, in the evaluation or control of community air pollution or air-pollution nuisances.

These values are reviewed annually by the Committee on Threshold Limits for changes, revisions, or additions as further information becomes available. The Committee welcomes the suggestion of substances to be added to the list and also comments, references, or reports of experience with these materials.

Recommended Values

Gases and Vapors

Substance	PPM	Approx. Mg. per Cu. M.
Acetaldehyde	200	360
Acetic acid	10	25
Acetic anhydride	5	20
Acetone	1000	2400
Acetylene tetrabromide	1	14
Acrolein	0.5	1.2
Acrylonitrile	20	45
Allyl alcohol	5	12
Allyl chloride	5	15
Allyl propyl disulfide	2	12
Ammonia	100	70
Amyl acetate	200	1050
Amyl alcohol (isoamyl alcohol)	100	360
Aniline	5	19
Arsine	0.05	0.2
Benzene (benzol)	25	80
Benzyl chloride	1	5
Bromine	0.1	0.7
* Butadiene (1,3-butadiene)	1000	2200
Butanone (methyl ethyl ketone)	250	740
Butyl acetate (n-butyl acetate)	200	950
Butyl alcohol (n-butanol)	100	300
Butylamine	5	15
Butyl cellosolve (2-butoxyethanol)	50	240
Carbon dioxide	5000	9000
Carbon disulfide	20	60
Carbon monoxide	100	110
Carbon tetrachloride	25	160
Cellosolve (2-ethoxyethanol)	200	740
Cellosolve acetate (2-ethoxyethyl acetate)	100	540
Chlorine	1	3
Chlorine trifluoride	0.1	0.4
Chlorobenzene (monochlorobenzene)	75	350
* Chloroform (trichloromethane)	50	240
1-Chloro-1-nitropropane	20	100
* Chloropicrin	0.1	0.7

1. Copied from A.M.A. Archives of Industrial Health, September 1959.

* Change in value previously listed.

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Substance	PPM	Approx. Mg. per Cu.M.
Chloroprene (2-chloro-1,3-butadiene)	25	90
Cresol (all isomers)	5	22
Cyclohexane	400	1400
Cyclohexanol	100	410
Cyclohexanone	100	400
Cyclohexene	400	1350
Cyclopropane	400	690
Decaborane	0.05	0.3
Diacetone alcohol (4-hydroxy-4-methyl-2-pentanone)	50	240
Diborane	0.1	0.1
o-Dichlorobenzene	50	300
Dichlorodifluoromethane	1000	4950
1,1-Dichloroethane	100	400
1,2-Dichloroethane (ethylene dichloride)	100	400
1,2-Dichloroethylene	200	790
Dichloroethyl ether	15	90
Dichloromonofluoromethane	1000	4200
1,1-Dichloro-1-nitroethane	10	60
Dichlorotetrafluoroethane	1000	7000
Diethylamine	25	75
Difluorodibromomethane	100	860
Diisobutyl ketone	50	290
Dimethylaniline (N-dimethylaniline)	5	25
Dimethylsulfate	1	5
Dioxane (diethylene dioxide)	100	360
Ethyl acetate	400	1400
Ethyl acrylate	25	100
Ethyl alcohol (ethanol)	1000	1900
Ethylamine	25	45
Ethylbenzene	200	870
Ethyl bromide	200	890
Ethyl chloride	1000	2600
Ethyl ether	400	1200
Ethyl formate	100	300
Ethyl silicate	100	850
Ethylene chlorohydrin	5	16
Ethylenediamine	10	30
Ethylene dibromide (1,2-dibromoethane)	25	190
Ethylene imine	5	9
Ethylene oxide	50	90
Fluorine	0.1	0.2
Fluorotrichloromethane	1000	5600
Formaldehyde	5	6
Furfural	5	20
Gasoline	500	2000
Heptane (n-heptane)	500	2000
Hexane (n-hexane)	500	1800
Hexanone (methyl butyl ketone)	100	410
Hydrazine	1	1.3
Hydrogen bromide	5	17
Hydrogen chloride	5	7
Hydrogen cyanide	10	11
Hydrogen fluoride	3	2
Hydrogen peroxide, 90%	1	1.4
Hydrogen selenide	0.05	0.2
Hydrogen sulfide	20	30
Iodine	0.1	1
Isophorone	25	140
Isopropylamine	5	12
Mesityl oxide	25	100
Methyl acetate	200	610
Methyl acetylene	1000	1650
Methyl acrylate	10	35
Methyl alcohol (methanol)	200	260
Methyl bromide	20	80
Methyl cellosolve (2-methoxyethanol)	25	80
Methyl cellosolve acetate (ethylene glycol mono methyl ether acetate)	25	120
Methyl chloride	100	210
Methylal (dimethoxymethane)	1000	3100
Methyl chloroform (1,1,1-trichloroethane)	500	2700
Methylcyclohexane	500	2000
Methylcyclohexanol	100	470
Methylcyclohexanone	100	460
Methyl formate	100	250
Methyl isobutyl carbinol (methyl amyl alcohol)	25	100
α-Methyl styrene	100	480
Methylene chloride (dichloromethane)	500	1750
Monomethyl aniline	2	9
Naphtha (coal tar)	200	800
Naptha (petroleum)	500	2000
Nickel carbonyl	0.001	0.007
Nitric acid	10	25
p-Nitroaniline	1	6
Nitrobenzene	1	5
Nitroethane	100	310
Nitrogen dioxide	5	9
Nitroglycerin	0.5	5
Nitromethane	100	250
2-Nitropropane	50	180
Nitrotoluene	5	30
Octane	500	2350
Ozone	0.1	0.2
Paradichlorobenzene	75	450
Pentane	1000	2950
Pentanone (methyl propyl ketone)	200	[illegible]
Perchlorethylene (tetrachloroethylene)	200	1350
Phenol	5	19
Phenylhydrazine	5	22
Phosgene (carbonyl chloride)	1	4
Phosphine	0.05	0.07
Phosphorus trichloride	0.5	3
Propyl acetate	200	840
Propyl alcohol (isopropyl alcohol)	400	980
Propyl ether (isopropyl ether)	500	2100

Gases and Vapors (cont.)

Substance	PPM	Approx. Mg. per Cu. M.
Propylene dichloride (1,2-dichloropropane)	75	350
Propylene imine	25	60
Propylene oxide	100	240
Pyridine	10	30
Quinone	0.1	0.4
Stibine	0.1	0.5
Stoddard solvent	500	2900
Styrene monomer (phenylethylene)	100	420
Sulfur dioxide	5	13
Sulfur hexafluoride	1000	6000
Sulfur monochloride	1	6
Sulfur pentafluoride	0.025	0.25
Tertiary butyl alcohol	100	300
p-Tertiary butyltoluene	10	60
1,1,2,2-Tetrachloroethane	5	35
Tetrahydrofuran	200	590
Tetranitromethane	1	8
Toluene (toluol)	200	750
o-Toluidine	5	22
Tolylene-2,4-diisocyanate	0.1	0.7
Trichloroethylene	200	1050
Triethylamine	25	100
Trifluoromonobromomethane	1000	6100
Turpentine	100	560
Vinyl chloride (chloroethylene)	500	1300
Vinyl toluene	100	480
Xylene (xylol)	200	870
Xylidine	5	25

Toxic Dusts, Fumes, and Mists

Substance	Mg. per Cu. M.
Aldrin (1,2,3,4,10,10-hexachloro-1,4,4a,5,8,8a-hexahydro-1,4,5,8-dimethanonaphthalene)	0.25
Ammate (ammonium sulfamate)	15
Antimony	0.5
ANTU (alpha-naphthyl-thiourea)	0.3
Arsenic	0.5
Barium (soluble compounds)	0.5
Beryllium	2γ/m³
Cadmium oxide fume	0.1
Calcium arsenate	0.1
Chlordane (1,2,4,5,6,7,8,8-octachloro-3a,4,7,7a-tetrahydro-4,7-methanoindane)	2
Chlorinated camphene, 60%	0.5
Chlorinated diphenyl oxide	0.5
Chlorodiphenyl (42% chlorine)	1
Chlorodiphenyl (54% chlorine)	0.5
Chromic acid and chromates (as CrO_3)	0.1
Crag herbicide (sodium 2-(2,4-dichlorophenoxy) ethanol hydrogen sulfate)	15
Cyanide (as CN)	5
2,4-D(2,4-dichlorophenoxyacetic acid)	10
DDT (2,2-bis(p-chlorophenyl)-1,1,1-trichloroethane)	1
Dieldrin (1,2,3,4,10,10-hexachloro-6,7-epoxy-1,4,4a,5,6,7,8,8a-octahydro-1,4,5,8-dimethano-naphthalene)	0.25
Dinitrobenzene	1
Dinitrotoluene	1.5
Dinitro-o-cresol	0.2
EPN (O-ethyl O-p-nitrophenyl thionobenzenephosphonate)	0.5
Ferbam (ferric dimethyl dithiocarbamate)	15
Ferrovanadium dust	1
Fluoride	2.5
Hydroquinone	2
Iron oxide fume	15
Lead	0.2
Lead arsenate	0.15
Lindane (hexachlorocyclohexane, gamma isomer)	0.5
Magnesium oxide fume	15
Malathion (O,O-dimethyl dithiophosphate of diethyl mercaptosuccinate)	15
Manganese	6
Mercury	0.1
Mercury (organic compounds)	0.01
Methoxychlor (2,2-di-p-methoxyphenyl-1,1,1,1-trichloroethane)	15
Molybdenum	
(soluble compounds)	5
(insoluble compounds)	15
Nicotine	0.5
Parathion (O,O-diethyl-O-p-nitrophenyl thiophosphate)	0.1
Pentachloronaphthalene	0.5
Pentachlorophenol	0.5
Phosphorus (yellow)	0.1
Phosphorus pentachloride	1
Phosphorus pentasulfide	1
Picric acid	0.1
Pyrethrum	2
Rotenone	5
Selenium compounds (as Se)	0.1
Sodium fluoroacetate (1080)	0.1
Sodium hydroxide	2
Strychnine	0.15
Sulfuric acid	1
TEDP (tetraethyl dithionopyrophosphate)	0.2
TEPP (tetraethyl pyrophosphate)	0.05
Tellurium	0.1
Tetryl (2,4,6-trinitrophenylmethylnitramine)	1.5
Thallium (soluble compounds)	0.1
Thiram (tetramethyl thiuram disulfide)	5
Titanium dioxide	15
Trichloronaphthalene	5

Toxic Dusts, Fumes, and Mists (cont.)

Substance	Mg. per Cu. M.	Substance	Mg. per Cu. M.
Trinitrotoluene	1.5	Warfarin (3-(α-acetonylbenzyl)-4-hydroxycoumarin)	0.5
Uranium		Zinc oxide fumes	5
(soluble compounds)	0.05	Zirconium compounds (as Zr)	5
(insoluble compounds)	0.25		
Vanadium			
(V_2O_5 dust)	0.5		
(V_2O_5 fume)	0.1		

Radioactivity: For permissible concentrations of radioisotopes in air, see "Maximum Permissible Amounts of Radioisotopes in the Human Body and Maximum Permissible Concentrations in Air and Water," Handbook 52, U. S. Department of Commerce, National Bureau of Standards, March, 1953. In addition, see "Permissible Dose from External Sources of Ionizing Radiation," Handbook 59, U.S. Department of Commerce, National Bureau of Standards, September 24, 1954.
U. S. Department of Commerce Handbook 52 has been superseded by Handbook 69, "Maximum Permissible Body Burdens and Maximum Permissible Concentrations of Radionuclides in Air and in Water for Occupational Exposure," subsequent to the presentation of this report.
Handbook 59, U. S. Department of Commerce, has been revised by addition of addendum, Apr. 15, 1958.

Mineral Dusts

Substance	MPPCF	Substance	MPPCF
Aluminum oxide	50	Silica	
Asbestos	5	high (above 50% free SiO_2)	5
Dust (nuisance, no free silica)	50	medium (5 to 50% free SiO_2)	20
Mica (below 5% free silica)	20	low (below 5% free SiO_2)	50
Portland cement	50	Silicon carbide	50
Talc	20	Soapstone (below 5% free SiO_2)	20

Tentative Values

Substance	PPM	Approx. Mg. per Cu.M.	Substance	PPM	Approx. Mg. per Cu.M.
Allyl glycidyl ether (AGE)	10	45	sec-Hexyl acetate	100	590
Boron trifluoride	1	3	Isopropyl glycidyl ether (IGE)	50	240
n-Butyl glycidyl ether (BGE)	50	270	Lithium hydride		25γ m³
Butyl mercaptan	10	35	Methyl mercaptan	50	100
Chlorine dioxide	0.1	0.3	Perchloromethyl mercaptan	0.1	0.8
Chloroacetaldehyde	1	3	Phenyl glycidyl ether (PGE)	50	310
Chlorobromomethane ($ClBrCH_2$)	400	2100	Phosphoric acid		1
Diglycidyl ether (DGE)	10	55	n-Propyl nitrate	25	110
Dimethyl formamide	20	60	1,2,3-Trichloropropane	50	300
1,1-Dimethyl hydrazine	0.5	1	Triorthocresyl phosphate		0.1
Dipropylene-glycolmethyl-ether	100	600	Yttrium & inorganic compounds		5
Ethyl mercaptan	250	640	Teflon decomposition products	*	*
Furfuryl alcohol	50	200	Pentaborane (B_5H_9)	*	*
Glycidol	50	150			

* Until more data are forthcoming, it is important that atmospheric concentrations of these materials to which workers are exposed must be kept as near 0 as possible.

(Signed): William L. Ball, H. E. Stokinger, Hervey B. Elkins, W. H. Reinhart, W. Clark Cooper, Keith H. Jacobson, Allan L. Coleman, Chairman and study if a pollution problem exists. In this connection work closely and confidentially with official pollution control agencies. (2) If there is a problem, recognize it, for pollution cannot be easily concealed. (3) Begin control measures through stack sampling, and general air and water sampling. (4) Begin a public relations program advising the community of such work. (5) Using the data obtained, begin research on methods for control through pilot studies. (6) Apply the results of research to engineering development of control facilities. (7) Install proved and tested control equipment. (8) Keep the plant neighbors informed of progress. (9) Invite the public to inspect the accomplishment and to celebrate the success. (10) Inform companion industries of pollution control techniques that may be useful to them.

1066 Engineering and Maintaining In-Plant Air Pollution Control. O. C. Thompson.
J. Air Pollution Control Assn. 9, 94-95, 120 (Aug. 1959).

The organization and programming for air pollution control begins with a clearly understood company policy. Written policy statements seem the exception rather than the rule. The author describes a five-step written policy of Union Carbide Chemicals, specifically covering process wastes and related community relations, as follows: (1) Design Engineering Departments are responsible for incorporating into the design of any new installations the means for disposal of all process wastes with a minimum disturbance to the plant community. (2) Each operating plant will assign to some individual the responsibility for proper disposal of process wastes. (3) Each operating plant will assign engineering and laboratory talent for continuing studies of waste disposal. (4) Each operating plant will take an active part in any local committee groups or branches of agencies or trade associations interested in industrial waste disposal. (5) Each operating plant will assign to some individual the responsibility of representing the company to the public on all matters pertaining to air or water waste disposal. This written policy has proved to be of great value. It puts the responsibility for plant wastes control squarely where it belongs—on the plant management. It makes clear that control of wastes begins with product research and development in the laboratories, and that this control is extended through engineering, and the design and construction of each plant unit.

1067 Stainless Steel Anti-Smog Mufflers—Cut Air Pollution. Industrial Publicity Department, Communications Counselors, Inc. J. Air Pollution Control Assn. 9, 83-84 (Aug. 1959).

The muffler is almost entirely fabricated from chromium-nickel stainless steel, in order to resist oxidation and corrosion at the high operating temperatures. It is designed to dispose of the unburned fuels present to the exhaust system of a gasoline engine. The muffler consists of a primary burning tube (pilot tube) through which the bulk of the exhaust gases pass during operations of low exhaust volume. Air is introduced through an adjustable opening into this tube and the resulting mixture is ignited by a long-reach spark plug. As the volume increases, the excess exhaust gases are carried through an area surrounding the pilot tube and receive air from an adjustable rectangular opening in the muffler shell. This portion of the exhaust mixture is burned in the same combustion area as that of the pilot tubes. The exit tube of the muffler is baffled to prevent the flame from protruding at the tail pipe. Laboratory tests, made with a gasoline-powered bus produced a satisfactory over-all removal of the smog-forming hydrocarbons.

1068 Enzyme Poisons of Auto Exhaust Gases. T. Bersin.
Vitalstoffe 3, (12) 160-165 (1959). German.

Tetraethyl lead and inorganic lead are known to have an inhibiting effect on enzyme actions. The unconsumed gasoline in auto exhausts contains unsaturated hydrocarbons tending to produce smoke and aerosols of lead compounds. The question is raised whether the absence of an increase in reports of toxic effects from lead compounds, while traffic density continues to increase, may be due to unsuitable diagnostic procedures. Central nervous system damages after exposure to tetraethyl lead have been reported to appear 14 years after the original accident. Other known toxic substances found in exhaust gases are carbon monoxide and 3,4-benzpyrene. Carbon monoxide is known to block iron-containing enzymes and produce a decline in performance. Among the unsaturated hydrocarbons in unburned gasoline are the olefins which, under specific atmospheric conditions react with the ozone of the air to produce the olefin ozonides, which are said to block enzymatic action because of the deflection of the active group. Technical measures are needed to control air pollution, including better utilization of gasoline to leave less unburned fuel, and the use of catalysts to combat pollution with olefins. -- Cond. from APCA Absts

1069 The Toxicity of Ozone, A Constituent of Smog. H. T. Freebairn. J. Appl. Nutrition 12, 2-13 (1959).

In Los Angeles, concentrations of ozone are present, during repeated attacks of air pollution which, under controlled laboratory experiments, have been shown to affect animals and damage plants. These concentrations are presently at the border line of man's susceptibility and certainly an increased concentration or duration of exposure to ozone in the Los Angeles atmosphere could cause injury to human beings. Ozone is an extremely toxic material to many types of organisms, and, because it is also toxic to man, its use is inadvisable as an aerial disinfectant in hospitals. Ozone can be classified as a specific inhibitor and it possesses a toxic activity which indicates that it is more active than hydrogen cyanide as a poison. Ozone not only destroys the outer cell membranes of living organisms, but also reversibly and irreversibly inhibits mitochondral oxygen uptake. There is a suggestion that the reversible inhibition is enzymatic and that the natural resistance of a cell is related to the size of the metabolic pool of reducing substances capable of countering the oxidizing effects of ozone. -- APCA Absts.

MANAGEMENT ASPECTS

1070 Patterns of Sickness Absence in a Railway Population. C. Gordon, A. R. Emerson and D. S. Pugh. Brit. J. Ind. Med. 16, 230-243 (July 1959).

This investigation was carried out in order to obtain morbidity statistics in a large industrial population with special reference to the effects of aging. The population chosen, the "railway research population", consisted of a sample of Scottish railwaymen, drawn from 5 of the 8 areas in the Scottish Region of British Railways. Only certain occupational grades were studied. Information was obtained over a period of one year by means of a detailed monthly return of (1) sickness absence data and (2) job changes. The nature of sickness absence within the railway research population was then studied. It was shown in all but one measure used that sickness tends to increase with age,the most important factor being the increase of long episodes. Examination of the frequency distribution of the duration of sickness episodes revealed that sickness absence tends to be taken in terms of weeks off rather than days off. Analysis of the daily variation in sickness absence showed that the total absence rate increased from Monday to Friday. There was a well-defined tendency for sickness to start on Mondays, and in longer episodes an additional tendency to start on Fridays. This was interpreted in terms of morale, both positive and negative. The re[illegible] for job changes were analyzed and the grades to which men were transferred were identified. The choice of suitable grades for older workers was discussed. It was concluded that working conditions might be important factors in the type of sickness absence experienced and that comparisons with other populations might be helpful in this context. -- Cond. from authors' abst.

1071 Two Schools of Thought About Executive Development. E. E. Jennings. Personnel J. 37, 370 (Mar. 1959).

This article points out that there are two commonly held theories of executive development. The first, the author has called the life-process theory, and the second, the skilled insight theory. In essence, the former theory holds that executives or executive performance are the

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end-result of many years of experience with the executive role and that brief training periods cannot essentially contribute anything to the executive's performance. On the other hand, the skilled insight theory argues that particular skills can be taught to the executive in the course of training and educational programs, so that the executive may greatly improve his performance. The author indicates that the organizational climate varies from one type of industry to another concerning adherence to these schools of thought. He does not indicate which school he favors. -- J. Occ. Med. Absts.

1072 How to Improve Safety Through Organization. R. Reed, Jr. Eng. Progress, Univ. Florida 13, 5-7 (June 1959).

Wholehearted support of a safety program by management is a basic requirement for success. The program, in turn, will give generous returns to management to compensate for the time, effort and expense incurred in its operation. Many of these returns are difficult to evaluate. In computing the reduction in the overhead of the firm derived from a lowered accident rate, it is easy to determine the medical and compensation payments incurred from an injury. But other expenses, such as time lost by foremen and fellow workers, by reason of accidents and the reduction of the productive capacity of the injured workers after their return to the job are more difficult to evaluate since they are hidden in the labor and overhead costs which are assigned to production under customary accounting systems. These hidden or indirect safety costs have been studied extensively and a consensus of this research shows, conservatively, that the indirect cost of accidents is four times as great as the direct costs represented by medical and compensation expense. The cost of industrial accidents in 1955 is estimated by the National Safety Council as $3,500,000,000, equivalent to $50 per worker. The author describes three basic methods for developing a safety organization and illustrates two setups by means of organization charts. If proper efforts are made to remove potential accident causes, and to correct conditions which have caused accidents, the injury rates will be reduced. These reduced rates in turn bring both direct and indirect savings, which, with the improved confidence of the personnel, will much more than pay for the cost and effort expended in operating the program and be reflected in lowered unit cost of the product.

ACCIDENTS AND PREVENTION

1073 Barrelmakers' Work Injuries Surveyed. Anon. Safety Standards 8, 16 (Sept.-Oct. 1959).

Except for furniture, cooperage manufacture had a more favorable work-injury record in 1957 than any other manufacturing operation in the lumber and wood products group of industries, according to a recent survey made by the U. S. Department of Labor's Bureau of Labor Statistics. But the cooperage manufacturing frequency rate of 34.0 disabling injuries and its severity rate of 2,393 man-days per million man-hours worked compared very unfavorably with the all-manufacturing rates of 11.4 and 754 respectively. The heaviest incidence of injuries occurred in the stave mills; commonest variety consisted of bruises and contusions, cuts or lacerations, strains or sprains. Interestingly, the highest frequency and severity rates were suffered by firms employing 20 to 49 employees, lowest by those employing 50 to 99. The highest average number of days lost or charged per disabling injury, however, occurred among the smallest firms, those employing from 1 to 19 employees. These and other findings are published under the title of "Work Injuries and Injury Rates in the Manufacture of Cooperage", BLS Report No. 145, conducted in response to a request of the Associated Cooperage Industries of America, Inc. The results are based on reports from 137 cooperage establishments employing more than 4,500 workmen.

1074 Accidents in a Naval Dockyard. C. P. Collins.
Brit. J. Ind. Med. 16, 208-215 (July 1959).

The high incidence of accidents in H.M. Dockyard, Singapore, during 1954 led to a more detailed recording and analysis in 1955-1956. The departmental accident rates per 1000 workers were recorded, together with the circumstances of all injuries resulting in the loss of more than one shift (two per working day, lasting 4 1/2 hours in the mornings and 3 3/4 hours in the afternoons). In the successive quarters of 1955, the number of accidents of all degrees of severity dropped steadily, but by 1956 they had leveled out at figures ranging from 1/5 to 1/4 of the original numbers. In 1956 the numbers of minor accidents reported were 44% of those for 1955, while cases requiring hospital treatment had fallen to 33.5%. This was balanced to some extent by an increase of trivial cases treated without loss of time by first aid in the workshops, but the total numbers still showed a reduction in the accident rate per 1000 workers of 26.2%. The ethnic groups employed all showed a similar decrease in accident rates, but the reduction was noticeably greater among the Malays than the Chinese or Indians. Analysis by category of causation showed that the lower incidence was largely due to improvement in the categories of handling stores, using hand tools and power-driven machinery, but attention to the causes of eye injuries occasioned a reduction of only 5.2%.

1075 Crane Booms vs. Power Lines. S. S. Elkins.
Natl. Safety News 80, 74, 76, 118-121 (Sept. 1959).

Each year, many deaths and serious injuries and much property damage result from crane boom contacts with power lines. In a 9-year period California reported 160 fatalities and 300 injuries due to crane boom contacts. Statistics show that death results in one out of every three injuries caused by accidental contact with high-voltage lines. The electrical nature of the problem suggests that safety groups in the electrical industry should assume leadership in any safety drive reaching across industry lines. Officials of the crane operators' union have offered cooperation, and help from the construction industry and insurance groups is anticipated. The utility industry's stake in reducing crane contact is a major one. In addition to the personal hazard, cranes cause extensive damage to lines and serious interruptions to service. The author discusses equipment involved, electric shock, basic precautions, location of lines, location of equipment, protective devices, and the selection of operators and ground crew.

1076 Laboratory Ventilation. J. C. Barrett.
Natl. Safety News 80, 26-27, 113-118 (Sept. 1959).

The author considers laboratory hood design, hood location, exhaust ductwork, air supply, and air conservation. Certain velocities for laboratory bench-type hoods are recommended by the American Conference of Governmental Industrial Hygienists. For chemical and moderate toxicity material, average face velocity should be a minimum of 100 fpm through the open door area, with an 80 fpm minimum at any point. For high toxicity and radioactive material this should be raised to an average of 125 to 200 fpm with an absolute minimum of 100 fpm. Some authorities claim certain laboratories (as in schools and universities) do not use high-toxicity materials regularly, and individual exposure may not be for a full working day. However, there is no guarantee that a material used in a hood on any given day for a particular project may not be succeeded by a material of high hazard—flammable or toxic. It is also known that with many materials the problem is not merely one of exposure for long periods; serious illness or death can occur from even one short exposure. With such materials as oxides of nitrogen, a single exposure may often be sufficient to kill an individual or impair his health seriously. The glove box hood is another common type of laboratory hood used for work with radioisotopes, with tuberculosis germs, and in many standard chemical laboratories. Here the chemist is entirely outside the hood, and his only contact with the interior is through the glove ports. Exhaust volumes for this hood are based on maintaining 50 fpm in velocity draft at any opening; usually this means an exhaust of 20 to 30 cfm of air for each glove box.

1077 An Approach to a Rational Method for Recommending Face Velocities for Laboratory Hoods. J. E. Peterson. Am. Ind. Hyg. Assn. J. 20, 259-266 (Aug. 1959).

Variables affecting the performance of laboratory hoods have been combined into an equation for the calculation of specific recommended face velocities of each hood. The equation is strictly emperical, and numerical values are assigned to each of the factors on the basis of judgment coupled with techniques developed for that purpose. In use, the Vapor Control Factor is modified by an Environment Factor and a Hood Characteristic Factor to achieve a face velocity which would be recommended for a "standard hood". Then, a statistic (the variance) is utilized to calculate a mean face velocity which will assure that 99% of the individual velocity measurements at the hood face will fall above a minimum, calculated as 75% of the mean face velocity for the "standard hood". Specifications of the "standard hood" are discussed, as is the technique of assigning numerical values to each of the factors in the equation. Values of the variance are determined by measurement, or are estimated from an included table of variances associated with hood types. -- Author's summary

1078 Protection of Flammable Liquids. Anon. Safety Maintenance 118, 42-43 (Sept. 1959).

Flammable liquid hazards present a greater fire potential to more industrial plants than any other fire hazards. The magnitude of this potential has steadily increased with the introduction of more extensive automated operations. Although the author is considering protection of the hazards of flammable liquids, technically the liquids will not burn; it is the vapors of these liquids that do burn or, in certain mixtures with air, explode. The rate of vaporization of a liquid depends upon its vapor pressure with the rate increasing with temperature rise. Flammable liquids at elevated temperatures present greater fire potential and designers of fire protection must recognize this fact. To prevent losses due to the use of flammable liquids in industrial plants, the problems must be carefully and continuously studied. First, the hazard or fire potential of flammable liquids must be recognized by those responsible for fire safety of industrial plants. Secondly, the hazard must be adequately protected by proper design of the operational equipment and the fire protection facilities. Eight ways to minimize the hazards of flammable liquids are given in the form of a table.

MISCELLANEOUS

1079 Tank Car Wash Water. G. Gutzeit. Ind. Wastes 4, 17-20 (Mar.-Apr. 1959).

At the Masury, Ohio manufacturing and maintenance plant of the General American Transportation Corporation, a treatment plant for wastes from washing tank cars went into operation in July 1957. This article describes the facilities and method of operation for these complex wastes. The cleaning operation for the 8,000 to 16,000 gallon railroad tank cars is periodically required before a change in loading, inspection, or repairs can be performed. A basic process for the treatment of these residuals was developed several years ago by the Research and Development Department of the General American Transportation Corporation. Basically, it involves segregation of the cars into the following categories, according to the last commodity carried: (1) Insoluble inert solids, such as asphalt, clay, and kaolin. (2) Gases and volatile liquids. (3) Insoluble organic liquids, such as petroleum products, vegetable oils, non-volatile solvents, and acids. (4) Soluble liquids, neutral and alkaline salts, and alkalies. (5) Taste and odor producing substances, such as phenols, creosols, etc., and non-metallic toxic compounds. Insoluble solids are dumped and incinerated if combustible. Gases and volatile liquids are dissipated into the atmosphere by steaming, unless the products are irritating or toxic. Phenolic materials and other aromatic compounds have to be treated in special installations, involving adsorption on bituminous coal or lignite (the solids being then removed by froth flotation): followed by aeration, lagooning for equalization, biological oxidation or chemical oxidation with chlorine, chlorine dioxide or ozone. Wash waters and stream condensate from tanks having been used for shipping insoluble organic liquids and soluble liquids are segregated, by using movable effluent launders and separated into two groups which are treated separately by methods which are described in detail.

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OCCUPATIONAL HEALTH HAZARDS
Derived from Industrial Health Reports
October 1960 through December 1960

Release No. 27 For Official Use Only

I. Chemical Health Hazards and Their Control

A. Inhalation Hazards Due to Vapors, Fumes, Mists, Gases and Dusts

1. Asbestos Dust: Further samples have been taken to determine the extent of exposure to asbestos dust by pipe coverers and insulators working aboard ship. Results of the samples taken are as follows:

Operation	Dust Count mppcf
Installation of asbestos cloth	5.5
Installation and sawing insulation block	20.0
Installation of insulation block	3.9
Sawing insulation block	27.0
Installing block insulation	11.7
Mixing magnesia cement	5.6
Sweep-up after coating asbestos on boiler	92.5
Rip-out of pipe insulation	6.8

In general, it is concluded that while cutting and installing insulation block and when ripping out old insulation, the dust counts usually exceed the safe concentration, assuming all the dust to be asbestos. When installing asbestos cloth and prefabricated insulation, the dust counts generally are within acceptable limits. It has been recommended that pipe coverers and insulators performing dusty jobs be required to wear dust respirators. In some cases, it may be feasible to wet down the insulating material before the work is begun, to reduce dust formation.

4. Fiber Glass Pad for Asbestos. The Value Engineering [illegible] has been looking for a substitute for amestie (asbestos material) in order to reduce the present high cost of insulation practices and to reduce the health hazard of asbestos work. The B.I. Thompson Fibreglass Company of Los Angeles, in conjunction with the Owens-Corning Company, has developed a fibreglass pad which withstands the temperature requirement and also reduces the final cost of the job. According to the manufacturers, fibreglass is made of finely pulverized ingredients, including sand, lime and metallic oxides. A mixture of silicates results after processing with no free silica present. They state that glass fibers are inert, non-toxic, non-allergic, and cause no lung hazard. The new fibreglass contains long smooth fibers which are claimed to be less irritating to the skin. Tentative heat tests have been conducted with fibreglass insulation to 1100 degrees F before any change in physical characteristics. Some fibreglass pads will be installed on a destroyer in the near future for further evaluation. (3)

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